Flood rise analysis proposal from LWG

Chip Humphrey to: Burt Shephard, Chip Humphrey, allen.elizabeth, GAINER Tom, Gina Grepo-Grove, Jennifer L Peterson, 04/01/2010 03:59 PM

Cc: Eric Blischke

Modeling issue #2

The LWG is interested in using the EFDC model to run flood rise simulations instead of the HEC-RAS model that we previously recommended. The LWG's brief write-up on use of EFDC for this purpose & its advantages vs HEC-RAS are in Carl's email below. We are interested in any feedback from those familiar with these models so we can advise the LWG on how to proceed.

Also, please note that while this description indicates it would be used in remedial design, it is our expectation that flood rise potential will be addressed in the FS as well.

thanks
Chip

----- Forwarded by Chip Humphrey/R10/USEPA/US on 04/01/2010 03:35 PM -----

RE: Flood analysis

Carl Stivers to: Chip Humphrey 04/01/2010 03:33 PM

Chip -

Regarding how we would use the EFDC model and why:

As part of the remedial design for the areas of potential concern (AOPCs), it is necessary to analyze the effects that proposed changes in bathymetry have on river stage height. This analysis is typically conducted using a one-dimensional hydrodynamic model that predicts stage height changes caused by changes in the cross-sectional area of the river. For the Lower Willamette River (LWR), a two-dimensional hydrodynamic model already exists and it is based on the Environmental Fluid Dynamics Code (EFDC) framework (Hamrick 1992). This model has been calibrated and validated for the LWR and deemed reliable for evaluating its hydrodynamic behavior. Therefore, we propose to use this model to analyze the potential effects of proposed remedial alternatives on stage height during flood events.

EFDC is a modeling framework capable of performing two- or three-dimensional hydrodynamic simulations and it has been approved by the U.S. Environmental Protection Agency (EPA). This model has been successfully applied in numerous hydrodynamic, sediment transport, and chemical fate studies. Using this framework, a two-dimensional, vertically-averaged model of the LWR has been developed by the Lower Willamette Group (LWG). The model domain extends from Willamette Falls to the confluence with the Columbia River. This model has been calibrated to measured water stage heights and current velocities

collected at several locations. The model is currently being used for the RI/FS study of the LWR, with the hydrodynamic results being used to drive sediment transport and chemical fate models.

This hydrodynamic model is sufficiently reliable for analyzing the effects of bathymetry changes on river stage height. Thus, development, calibration and application of a one-dimensional hydrodynamic model are not necessary. Most importantly, the predictions of the two-dimensional model will be at least as accurate, and probably more accurate, than a one-dimensional model, mainly because the two-dimensional model provides a more realistic representation of the geometry and bathymetry of the LWR. This characteristic of the two-dimensional model makes it possible to simulate recirculation patterns and backwater effects that locally modify river stage height, which are small spatial scale features that are not captured by a one-dimensional model. Therefore, there is no need to develop a new one-dimensional model of the LWR that will, at best, provide the same results as the existing two-dimensional model.

Reference

Hamrick, J.M. 1992. A Three-Dimensional Environmental Fluid Dynamics Computer Code: Theoretical and Computational Aspects. College of William and Mary, Virginia Institute of Marine Sciences. Special Report 317. 63 pp.

Regarding Reasons Why We Want to Use EFDC:

Per the above EFDC will be more accurate and capture smaller scale features than developing a new 1-D HEC-RAS model. Also, given that the EFDC model is all set up and calibrated, there will be very little additional time to run the flooding simulations. In contrast, if we use HEC-RAS we will have to parameterize, troubleshoot, and calibrate an entirely new model for the river. We are completely familiar with HEC-RAS and its various uses, but even so, it will take significant additional time (and cost) to develop and calibrate an entirely new model. We do not need to purchase the model software (we already have it). None the less, the labor effort associated with developing and calibrating an entirely new model for the site are significant and we estimate in the range of $40 to $50K in labor costs. Given that EFDC will be both more accurate and cost less to use, the LWG prefers the use of EFDC for this purpose.

Thanks.

Carl

Carl Stivers

ANCHOR QEA, LLC

cstivers@anchorqea.com

23 S. Wenatchee Ave, Suite 120

Wenatchee, WA 98801

Phone: 509.888.2070

Fax: 509.888.2211

ANCHOR QEA, LLC

www.anchorqea.com

-----Original Message-----
From: Humphrey.Chip@epamail.epa.gov [mailto:Humphrey.Chip@epamail.epa.gov]
Sent: Thursday, April 01, 2010 3:03 PM
To: Carl Stivers
Subject: RE: Flood analysis

Carl

Can you send me a short description of how you would intend to use the

ERDC model in lieu of the HEC RAS model for predicting flood rise as

part of the FS & reasons why (including the cost savings of not having

to purchase the software) you want us to consider this? I need to send

it around and want to make sure I capture your perspective correctly.

If you've already provided something just point me to it.

thanks

Chip